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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YONGHUA LI and XU WANG¹

Appeal 2017-010229
Application 14/015,241
Technology Center 2800

Before BEVERLY A. FRANKLIN, RAE LYNN P. GUEST, and
JENNIFER R. GUPTA, *Administrative Patent Judges*.

GUEST, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner’s decision to reject claims 1–20 under 35 U.S.C. § 101, as claiming ineligible subject matter.² *See* Examiner’s Final Office Action, dated July 13, 2016 (“Final Act.”); Examiner’s Answer, dated May 30, 2017 (“Ans.”). We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ The Appellant/Applicant in this case is the real party in interest Ford Global Technologies LLC. *See* Appellant’s Appeal Brief 1, filed April 13, 2017 (“Appeal Br.”).

² The Examiner has expressly stated that the claims distinguish over the closest prior art of record. Final Act. 6–7.

Appellant's invention is related to a method for determining equivalent circuit model parameters for modeling of a battery circuit when estimating battery power capability in a vehicle, particularly an electric or hybrid electric vehicle. Specification ¶¶ 1–2 (“Spec.”). In particular, the invention is described as calculating the model parameters “using an optimal data fitting process, which may employ, for example, an extended Kalman filter (EKF).” Spec. ¶ 2. The Specification explains that a concern with using EKF as an optimal data fitting process in determining circuit model parameters is “that the estimated values for the parameters are based on data fitting from measurement data,” which “can lead to model mismatch, as well as being corrupted by sensor biases or measurement noises in the measurement data” and “biased estimation of the parameters.” *Id.* The Specification states that the recited battery equivalent circuit model based on battery temperature or state-of-charge (SOC) measurements, which are properly limited in an EKF, “allows for erroneous estimations to be corrected, with the EKF converging to relatively accurate values for the circuit model parameters, with desired speed.” *Id.* ¶ 8.

Independent claim 1 is exemplary of the subject matter on appeal and is reproduced below:

1. A method comprising:
 - employing a battery circuit model, including a first resistance (r_1) in series with a second resistance (r_2) and a capacitance (C) in parallel;
 - measuring battery temperature;
 - setting upper and lower limits for r_1 , r_2 and C based on the temperature;
 - determining a battery power capability by applying an Extended-Kalman-Filter to determine r_1 , r_2 and C within the set limits;

a controller controlling operation of a battery based on the battery power capability

Br. 18, Claim App'x. Claims 1 and 9 are independent claims directed to a “method,” namely a method of employing a battery circuit model. Claim 9 differs from claim 1 only in that the claim 1 recites “measuring battery temperature” and setting the model parameters “based on the temperature,” while claim 9 recites “measuring battery state-of-charge” and setting the model parameters “based on the state-of-charge.” Claim 18, however, is directed to “An electric vehicle,” comprising (1) a battery, and (2) a controller estimating battery power capability by applying a battery circuit model.

II. DISCUSSION

We review the appealed rejections for error based upon the issues identified by Appellant and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (*cited with approval in In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (“[I]t has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections.”)).

The Examiner rejects claims 1–20 under pre-AIA 35 U.S.C. § 101 as being directed to a judicial exception, namely an abstract idea of mathematical relations and/or algorithms, without significantly more. Final Act. 2.

An invention is patent eligible if it claims a “new and useful process, machine, manufacture, or composition of matter.” 35 U.S.C. § 101. However, the Supreme Court has long interpreted 35 U.S.C. § 101 to include implicit exceptions: “[l]aws of nature, natural phenomena, and abstract

ideas” are not patentable. *E.g.*, *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, we are guided by the Supreme Court’s two-step framework, described in *Mayo* and *Alice*. *Id.* at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework, we first determine what concept the claim is “directed to.” *See Alice*, 573 U.S. at 219 (“On their face, the claims before us are drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk.”); *see also Bilski v. Kappas*, 561 U.S. 593, 611 (2010) (“Claims 1 and 4 in petitioners’ application explain the basic concept of hedging, or protecting against risk.”).

Concepts determined to be abstract ideas, and thus patent ineligible, include certain methods of organizing human activity, such as fundamental economic practices (*Alice*, 573 U.S. at 219–20; *Bilski*, 561 U.S. at 611); mathematical formulas (*Parker v. Flook*, 437 U.S. 584, 594–95 (1978)); and mental processes (*Gottschalk v. Benson*, 409 U.S. 63, 69 (1972)). Concepts determined to be patent eligible include physical and chemical processes, such as “molding rubber products” (*Diamond v. Diehr*, 450 U.S. 175, 191 (1981)); “tanning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting ores” (*id.* at 182 n.7 (quoting *Corning v. Burden*, 56 U.S. 252, 267–68 (1854))); and manufacturing flour (*Benson*, 409 U.S. at 69 (citing *Cochrane v. Deener*, 94 U.S. 780, 785 (1876))).

In *Diehr*, the claim at issue recited a mathematical formula, but the Supreme Court held that “[a] claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a

mathematical formula.” *Diehr*, 450 U.S. at 176; *see also id.* at 191 (“We view respondents’ claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula.”). Having said that, the Supreme Court also indicated that a claim “seeking patent protection for that formula in the abstract . . . is not accorded the protection of our patent laws, . . . and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment.” *Id.* (citing *Benson* and *Flook*); *see, e.g., id.* at 187 (“It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.”).

If the claim is “directed to” an abstract idea, we turn to the second step of the *Alice* and *Mayo* framework, where “we must examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent eligible application.” *Alice*, 573 U.S. at 221 (quotation marks omitted). “A claim that recites an abstract idea must include ‘additional features’ to ensure ‘that the [claim] is more than a drafting effort designed to monopolize the [abstract idea].’” *Id.* (quoting *Mayo*, 566 U.S. at 77). “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.*

The PTO recently published revised guidance on the application of § 101. USPTO’s January 7, 2019, Memorandum, *2019 Revised Patent Subject Matter Eligibility Guidance* (“Memorandum”). Under that guidance, we first look to whether the claim recites:

(1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human interactions such as a fundamental economic practice, or mental processes); and

(2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)).

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look to whether the claim:

(3) adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional” in the field (*see* MPEP § 2106.05(d)); or

(4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

See Memorandum.

We have considered the Examiner’s findings and the Appellant’s arguments and are not persuaded the Examiner erred in rejection the claims under 35 U.S.C. § 101.

Under the guidance, in the first step (1) of our analysis, we consider whether the Examiner erred in determining that the claims recite a judicial exception. With respect to the method claims 1 and 9, the Examiner finds that the steps of employing a battery circuit model, setting upper and lower limits for the model’s parameters based on the battery temperature, and determining a battery power capability by applying an EKF to determine the model’s parameters within set limits are “limitations [] about organizing data

through mathematical correlations or algorithms, similar to the concepts found abstract previously by the courts.” Final. Act. 2, 3–4 (citing *Benson*, 409 U.S. at 67, *Parker v. Flook*, 437 U.S. at 594 (1978), *Diehr*, 450 U.S. at 188 (1981), *In re Grams*, 888 F.2d 835 (Fed. Cir. 1989), and *Digitech Image Tech., LLC v. Electronics for Imaging, Inc.* (758 F.3d 1344) (Fed. Cir. 2014)). Similarly, with respect to vehicle claim 18, the Examiner finds that the functional limitations are mathematical correlations or algorithms. *Id.* at 4.

Appellant does not dispute the Examiner’s finding that the claims recite a judicial exception. *See e.g.*, Appeal Br. 8 (“The mere fact that mathematical formulas and a battery circuit model are employed during this process does not change the overall method in claim 1 to an abstract idea.”). Rather, Appellant argues that the claims as a whole are not directed to a judicial exception but that the claim elements amount to significantly more than an abstract idea. *See e.g.*, Appeal Br. 8–9. According we agree with the Examiner that the claims recite an abstract idea, namely mathematical concepts, including a battery model and EKF, which is a method of mathematically manipulating varying data to converge the data to an estimated value. *See Spec.* ¶ 18 (“EKF is a method of nonlinear state estimation.”).

We next turn to the second step (2) of determining whether additional elements that integrate the judicial exception into a practical application.

The Examiner finds that the additional elements, namely the steps of measuring battery temperature, and a controller controlling the battery operation based on the modeled battery power capability, are not sufficient to amount to significantly more than the judicial exception because they “are

recited at a high level of generality, necessary, routine, or conventional to facilitate the application of the abstract idea.” Final Act. 3, 4 (citing e.g., *Alice*). Similarly, with respect to vehicle claim 18, the Examiner finds that the additional functional limitation of adjusting vehicle electric operations, are not sufficient to amount to significantly more than the judicial exception because they “are recited at a high level of generality, necessary, routine, or conventional to facilitate the application of the abstract idea.” Final Act. 4–5.

Appellant argues that the claim as whole is directed to an “improvement to another technology—that is, improvement to battery operation itself by being [able] to accurately determine the battery’s power capability, with this power capability significant because the controller controls the battery operation based upon this determination in order to avoid any deleterious effects on the battery.” Reply Br. 5–6. Appellant argues that the temperature measurement “is needed to achieve precise control of operation of the battery” because the measurement is used to set the model parameter limits “without which the battery power capability being accurately determined by the EKF may be inaccurate . . . causing the operation of the battery to be based on incorrect battery power capability.” Appeal Br. 9.

In order to show that the invention is an improvement in battery operation, the disclosure must provide sufficient details such that one of ordinary skill in the art would recognize the claimed invention as providing an improvement. *Compare McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314–16 (Fed. Cir. 2016) (the specification explained how the particular rules recited in the claim enabled the automation of specific

animation tasks), *with Affinity Labs of Tex. v. DirecTV, LLC*, 838 F.3d 1253, 1264–65 (Fed. Cir. 2016) (the specification failed to provide details regarding the manner in which the invention accomplished the alleged improvement); *see* MPEP § 2016.05(a).

We disagree with Appellant that the invention describes “precise control of operation of the battery” or any specific improvement in the operation of the battery given a more accurate model for battery power capability, as argued. The Specification lacks any description or evidence as to how the battery operation or vehicle operation is improved, or even necessarily controlled, based on the battery power estimation. Rather, the Specification describes applying the battery power capability estimation only in a general non-specific way. *See* Spec. ¶ 38 (“The battery power capability may be, for example, displayed to a vehicle driver, may be used to adjust, control or regulate vehicle operations based on the estimated battery power capability, or both.”). Thus, the Specification lacks sufficient detail to find that the claimed invention improves battery operations as argued by Appellant.

Similarly, the claims reflect no improvement in battery operation, either specifically or generally. *Compare Enfish, LLC v. Microsoft Corp.*, 822 F.3d. 1327, 1332 (Fed. Cir. 2016) (the claim recited a specific data structure which is described in the specification as improving the way computers store and retrieve data from memory), *with Intellectual Ventures I LLC v. Symantec Corp.*, 838 F.3d 1307, 1315–1316 (Fed. Cir. 2016) (the claims themselves did not have any limitations that addressed the alleged improvement). The claims merely recite a general step of “controlling operation of a battery” or “adjusting vehicle electric operations,” and

provide no specifics as to how to control or adjust operations to achieve any actual improvement.

Appellant argues that the additional elements, namely the steps of measuring battery temperature, and a controller controlling the battery operation based on the modeled battery power capability (claims 1 and 9), or the particular recitations of a battery and a controller (claim 18), apply the judicial exception in a meaningful way beyond generally linking the use of the judicial exception to a particular technological environment, such that the claim as a whole is more than a drafting effort designed to monopolize the exception. Appeal Br. 8–9, 14–17. Appellant also asserts that the controller controlling operation is “significant post solution activity” and not “just a generalized output.” Appeal Br. 9. Appellant argues that the abstract idea is thus meaningfully linked to a particular technological environment and does not seek to tie up a judicial exception such that others cannot practice it. *Id.* 10.

The Examiner notes that the step of “measuring battery temperature” is recited broadly and is “merely a data collection step.” Ans. 6. The Examiner notes the claim does not recite “the structure of the controller, the mechanism for controlling the operation, or the kind of battery operations that are controlled.” *Id.*

We agree with the Examiner that the additional elements are so broadly recited that they merely generally link the judicial exception to a technological environment and that there is no significant extra-solution (pre-solution or post-solution) activity to the judicial exception. MPEP § 2106.05(e)–(h). Further, we determine that the limitation “control the battery operation with a controller” to be little more than an equivalent of

adding the words “apply it” to the judicial exception, i.e., the mere instructions to implement the abstract idea on a computer. The claims do not recite significantly more because the claimed method (claims 1 and 9) and claimed vehicle (claim 18) use a particular machine—“a battery.” Additional elements that invoke machinery merely as a tool to perform an existing process will generally not amount to significantly more than a judicial exception. *See, e.g., Versata Development Group v. SAP America*, 793 F.3d 1306, 1335 (Fed. Cir. 2015).

In particular, we agree with the Examiner that the subject matter of the claims most resembles that of *Parker v. Flook*, 437 U.S. 584 (1978). In *Flook*, the claims were directed to updating alarm limits for a catalytic conversion process and recited an initial step which merely measures the present value of the process variable (e.g., the temperature); an intermediate step which mathematically calculates an updated alarm-limit value; and a final step in which the actual alarm limit is adjusted to the updated value. *Id.* Unlike in our case, in which the preamble only recites “a method,” the preamble in *Flook* recited a field of use, namely a catalytic chemical conversion, but did not meaningfully limit the steps recited in the claims. Like the data collection step in *Flook*, the steps of measuring a battery temperature and measuring a battery state of charge is mere data gathering, and is described so generically with respect to any model that may be employed that it does not amount to significantly more than the judicial exception.

While the present claims, unlike in *Flook*, further include a post-solution step of “controlling a battery operation” using a controller, this limitation does not have any specificity to it or link to the model to render it

more than insignificant post-solution activity. Unlike in *Diamond v. Diehr*, 450 U.S. 175 (1981), where the post-solution activity, namely controlling the press is very specific with respect to designated outcomes of the mathematical calculation, namely “to open when the comparison indicates equivalence, meaning that the molded product is cured,” the present claims are too generic to constitute significantly more. *See also Classen Immunotherapies Inc. v. Biogen IDEC*, 659 F.3d 1057, 1066–68 (Fed. Cir. 2011) (the immunization step, which only immunized where the analysis step resulted in showing lower risk for chronic immune-mediated diseases, was meaningful because it integrated the results of the analysis into a specific and tangible method). *Cf. Electric Power Group, LLC v. Alstom, S.A.*, 830 F.3d 1350, 1356 (Fed. Cir. 2016) (claiming a particular solution to a problem or a particular way to achieve a desired outcome may provide significantly more). The phrase “controlling operation of a battery based on the battery power capability” does not inform how operation of a battery is controlled. Is it turned on or off, is it cooled, is it just further monitored, is it charged further, et cetera? Similarly, claims do not recite what aspect of the battery power capability would trigger a controlling operation. What value calculated by the model would trigger what specific controlling operation? These details are neither recited in the claims nor described in the Specification in any detail. *See Spec.* ¶ 38.

Further, taking the claims as a whole and considering the steps of measuring battery temperature and a controller controlling the battery operation based on the modeled battery power capability in view of the mathematical limitation that are judicial exceptions does not change our analysis. The claims are not directed to more than applying the judicial

exception in the most generic way to a generic battery. MPEP § 2106.05(f). As in *Mayo*, where the steps merely required doctors to apply the judicial exception in any generic manner that the doctor chose to do, in the present case, the claims as a whole provide no guidance to the skilled artisan as to how or when to apply the judicial exception merely because the judicial exception is being applied in the context of a battery. Here, the presence of a battery and/or a controller that “controls” the battery merely define the field of use linked to the judicial exception. There is no description of transforming the battery or any actual description of improving the battery. *See* MPEP § 2106.05(c).

Finally, we look to see if the additional elements, namely the steps of measuring battery temperature and a controller controlling the battery operation based on the modeled battery power capability are (3) more than “well-known, routine, and conventional” so as to render the claim subject matter eligible or (4) simply append “well-known, routine, and conventional” elements, particularly at a high level of generality, to the judicial exception. The Examiner determines that the additional elements fall into the latter category (Ans. 6), and Appellant does dispute that they do not. *See generally* Appeal Br.; Reply Br. Indeed, what the Examiner finds novel and non-obvious is the use of the particular battery power capability model (a mathematical equation) in combination with EKF (another mathematical equation specifically for data manipulation). Final Act. 6–7. The additional steps of taking a battery temperature measurement, measuring a battery state of charge, and the non-specific limitation of controlling battery operations with a controller are all well-known and

conventional in the art.³ Similarly, with respect to claim 18, a generic electric vehicle and a generic controller are also well known and conventional in the art.

IV. CONCLUSION

On the record before us and for the reasons discussed above, we sustain the rejection maintained by the Examiner, namely the rejection of claims 1–20 under pre-AIA 35 U.S.C. § 101 for claiming ineligible subject matter.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

³ We note that claims 1 and 9 are directed to a generic “method” and recite a “battery,” but are not limited to a battery for an electric vehicle, or even a vehicle battery at all. The scope of the claims applies to any battery in existence that (1) has a temperature or state of charge and (2) could be modeled by a model that includes a first resistance (r_1) in series with a second resistance (r_2) and a capacitance (C) in parallel.